INFLUENCE OF TWO BICYCLES ON ROOF-RACK IN FUEL CONSUMPTION AND MAXIMUM SPEED ON AN AUTOMOBILE FUELED WITH LPG

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Abstract Two bicycles mounted on a roof-rack on the roof of an automobile influence a lot the fuel consumption and maximum speed of an automobile. The intention of the paper is to assess the increase of the fuel consumption in this case that two bicycles are mounted on a roof of an automobile. Measurements were made at different speeds starting with 60 km/h up to intended spped of 120 km/h. Obtained data are reliable and may be trusted due to the R2 coefficient of the implied equations.

1. INTRODUCTION

In order to reduce fuel costs, one solution consists in modifying gasoline engines for running with LPG – liquefied petroleum gas. This paper is concerning with a carburetor engine on a Daewoo Tico model car and its adaptations measuring the fuel consumption in the fifth gear at constant speed for different speeds. On the roof of the automobile was mounted a roof-rack with two bicycles for assessing the influence over the fuel consumption and on the maximum speed of the automobile.

2. MODIFYING THE ACTUAL SYSTEM OF FUELLING THE ENGINE

2.1 Technical modifications

Technical modifications were made at AUTOGAZ ROMANIA (2) in Bucharest on a Daewoo Tico model car with 140.000 km on board as shown in (3) and presented in detail in (4).

2.2 Measurements of fuel consumption

Measurements of fuel consumption were performed on the specified modified automobile in conditions as presented in (1) pp.45-50. Results of measurements at constant speed in fifth gear are presented in Table1.

Table 1
Fuel consumption in liters per 100 km versus speed with two bicycles installed on the roof

No.	*Speed [km/h]*	*Fuel consumption [l/100km]*
1	60	4.57
2	80	6.62
3	100	9.02
4	115	10.85

Data can be arranged in a graphic as shown in (Fig.1).

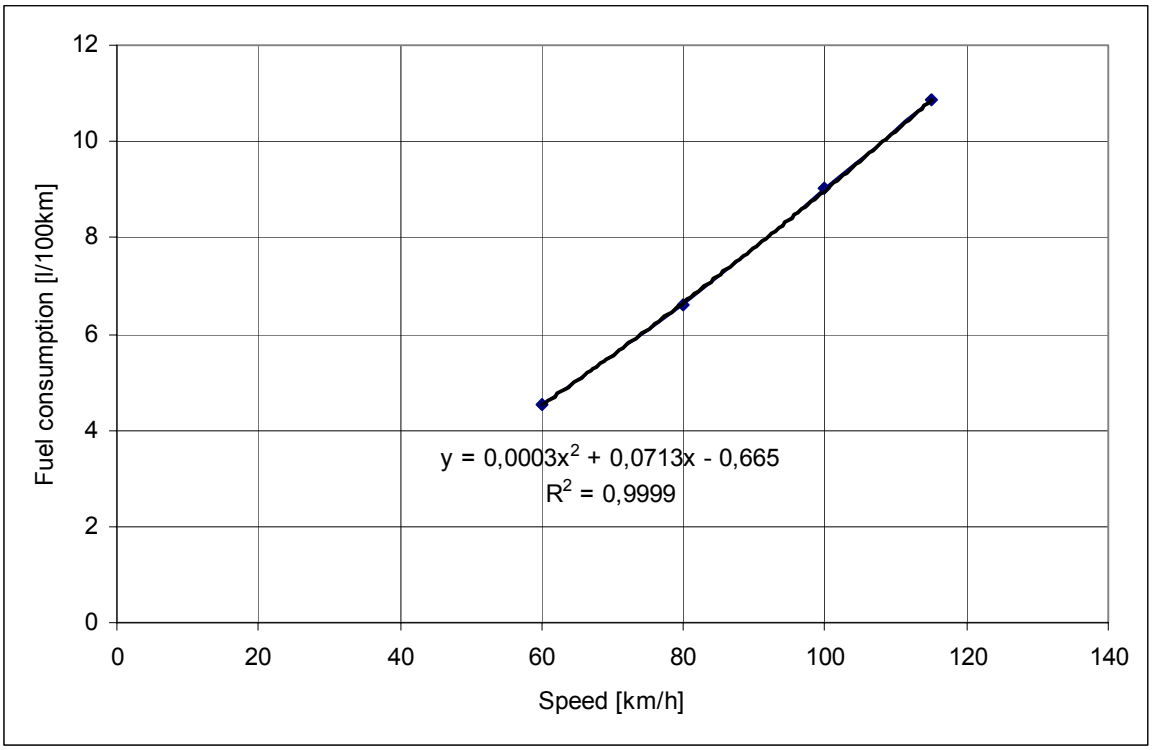

Fig.1. Fuel consumption in liters per 100 km versus speed at constant speed in fifth gear

3. MATHEMATICAL MODELATION

Data in figure 1 can be modeled in an equation computing the fuel consumption versus speed as presented in [1] pp.40-41.

$$C^{l}_{100km}=0.0003*V^{2}+0.0713*V-0.665 \quad (1)$$

where C^{l}_{100km} is fuel consumption in liters per 100 km in the fifth gear and V is the automobile speed in km/h.

4. AVERAGE ERROR

The average error computed for the data in table 1 shows a squared root error of 0.9999 showing a very good approximation for the measured values. Errors are computed as presented in (1) pp.41-43. in an automatic EXCEL sheet.

5. DISCUSSIONS

Maximum speed intended for measurements was impossible to obtain, due to the air drag represented by the two bicycles installed on the roof-rack of the automobile. Maximum speed obtained was 115 km/h with small deviations of 5 km/h between 110 km/h and 120 km/h as the gradient of the slope on the highway was positive or negative. Technical data specifications for the maximum speed indicate 140 km/h. The two bicycles installed on the roof of the automobile are presented in Fig.2.

Fig.2. The two bycicles installed on the roof of the automobile

The roof-rack and the two bicycles were secured with a synthetic rope tied to the inside passenger handles in order not to be thrown away at high speeds. Obtained data are important as in sport events like Tour de France same system is used to carry spare bicycles for the riders.

6. CONCLUSIONS

Data are available for computing the fuel consumption for a range of speeds from 60 km/h to 120 km/t. Previous experiments shows (1) that the speeds domain may be extended from 50 km/h to 140 km/h based on a reasonable accepted error of 2..3 % for the fifth gear of the studied automobile. It will be interesting for further investigation to register fuel consumption in the case of the air conditioning system ON, in order to asses the extra fuel consumption due to the extra power needed for the compressor running the AC system. Investigations are performed nowadays.

Also it will be interesting to study the differences from fueling the same automobile with gasoline and then for fuelling with LPG. Studies will be performed on the general wear of the engine components after a significant mileage of 100.000 kmor more. General data concerning costs for this specific automobile and with this specific MARINI LPG fueling system, shows that the initial price for mounting the extra system is recovered in a mileage of about 15.000 km.

It will be also of interest to compare fueling the same engine but equipped with fuel gasoline injection of EURO 4 level. There are LPG systems that can perform superior characteristics for the fuel injection both for gasoline and LPG fueling.

Future tests will involve bike-roof-racks with the two bicycles installed on the rear hatchback.
In Fig.3 it is presented the fuelling of the fuelling pump by a specialized truck in Pitesti.

Fig.3 Fuelling of the fuelling pump in Pitesti

7. REFERENCES

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